

**Statement of Work**  
**Stage Separation Wind Tunnel Test for the Space Launch System Program**

**1.0    Background**

The Space Launch System (SLS) program is part of NASA's mission to develop a cost-effective, next-generation space transportation system. The system will safely and reliably take human explorers to the Moon, Mars and on into the solar system.

The SLS project is preparing a stage separation aerodynamics database that characterizes the vehicle and interactions of the core vehicle and solid rocket boosters where aerodynamic effects are important. This speed regime of the first-stage separation event begins at about Mach 4.25. The aerodynamic database will be used to determine the SLS performance, stability & control effectiveness, and structural stability. Verification and validation of the concurrent database produced using Computational Fluid Dynamics (CFD) is needed through comparison with wind tunnel data from a complex force and moment instrumented wind tunnel model.

**2.0    Scope of Work**

NASA Langley Research Center and the SLS program shall utilize a wind tunnel to support the SLS program. To support the assessment of the current SLS configuration, the data to develop the aerodynamic database is required over the trajectory of the stage separation Mach number conditions. A 0.009-scale ( ~ 38" long) wind tunnel model has been built to test in a wind tunnel for the nominal Mach number of 4.25.

The polysonic wind tunnel test covers the Mach range 0.4-1.6 providing data for the early ascent phase for Ares I flight. The facility shall allow for the use of the existing model, sting, and balance hardware.

**3.0    Technical Requirements**

3.1    The contractor shall provide hardware requirements for testing in their wind tunnel. The contractor shall provide the wind tunnel facility and personnel to install the model hardware and perform the test matrix and shall provide all data reduction set-up, transmittals, data files and verification. The contractor shall perform check-loadings and angle-of-attack verification, wind off zeroes, and weight tare and high pressure tare procedures for force and moment testing. Based on the test matrix, the

contractor shall provide flow angularity evaluations. The contractor shall provide preliminary test data to LaRC on-site engineers for review during the test. Final data shall be provided two (2) weeks after completion of the test matrix to LaRC. The contractor shall disassemble the model and box the model to LaRC upon completion of the test.

NASA plans to provide for support of the test program. This support shall include NASA personnel participating in technical reviews to support the test entry, provide test engineering support during the test, the model, the sting, and adapter hardware. LaRC engineers shall be present during the test to review data.

This requirement covers an SLS stage separation force & moment test planned for the August 2014 timeframe. This test will be used to support the Critical Design Review (CDR) in 2015.

3.2 The contractor shall:

3.2.1 Provide NASA personnel model/sting/high pressure air requirements for entry in the wind tunnel.

3.2.2 Provide personnel to accept hardware interface checks at Modern Machine & Tool (if required).

3.2.3 Provide all data set-up, transmittals, data files and verification.

3.2.4 Provide angle-of-attack verification, wind-off zeros, and weight tare and high pressure tare procedures (if applicable to force and moment testing).

3.2.5 Install model hardware in the tunnel.

3.2.6 Perform wind tunnel tests during the weeks estimated below, per test matrices. Stage Separation test matrix attached.

3.2.7 Deliver preliminary test data during test for review by NASA on-site engineers.

3.2.8 Deliver finalized test data with 2 weeks following test completion.

3.2.9 Removal and disassembly of model and box and ship model to NASA upon completion of test.

#### **4.0 EXPORT CONTROL REQUIREMENTS**

- 4.1 All technical data generated shall comply with all applicable export and ITAR requirements, NASA policies, Langley management system procedures and any established international agreements required by NASA policies.

#### **5.0 MILESTONE SCHEDULE**

<b>Milestone (SLS DAC-2 F/M Testing)</b>	<b>SOW Reference</b>	<b>Deliverable</b>	<b>Date</b>
Provide model hardware requirements to NASA-LaRC	3.2.1		Approx. 7/21
Provide all data set-up, transmittals, data files and verification	3.2.3		Approx. 07/21
Provide angle-of-attack verification, wind-off zeros, and weight tare procedures	3.2.4		Approx. 07/21
Deliver model hardware to tunnel	3.2.5		Approx. 07/21
Install model hardware	3.2.5		08/01/14
Perform test per test matrix	3.2.6		08/01/14-09/01/14
Deliver preliminary test data	3.2.7		09/14/14
Deliver final test data	3.2.8		10/14/14
Disassemble model, box, and ship to NASA-LaRC	3.2.9		09/10/14